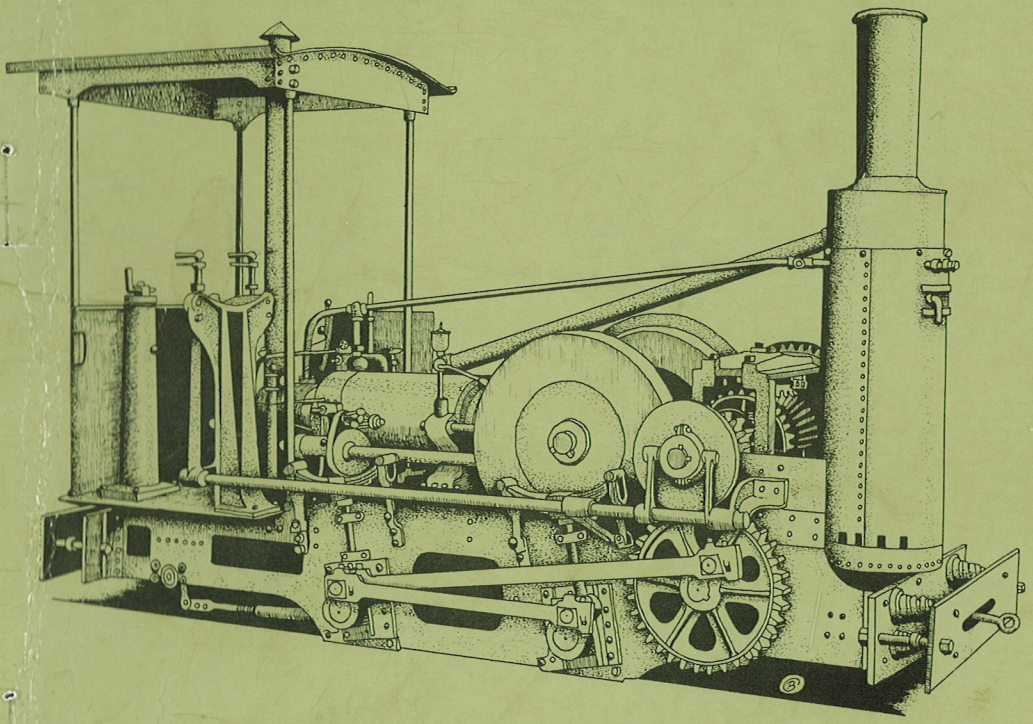
1776

The Eighteen Inch Gauge

ROYAL ARSENAL RAILWAY

AT WOOLWICH



B.R. Clarke & C.C. Veitch

Introduction

Although the existence of a narrow gauge railway system in the Royal Arsenal at Woolwich has been widely known, accurate and comprehensive information about it was not available during its working life. Various technical articles were published from time to time but such official records as may exist have not become available. The authors have been researching into the RAR (and other 18" gauge lines) for several years but do not regard this booklet as a conclusion to that work. It is intended rather to show how the RAR came to be built and what it was like, in a format which can be made available at modest cost.

Reference is made here to the productive work of the Arsenal and use of standard gauge railways only briefly to show the context in which 18" narrow gauge operated. Illustrations are selected for their information value and usefulness to model makers. Most are placed together in one section for ease of reference. An asterisk in the left hand margin of the text indicates that the subject is illustrated.

For the benefit of younger readers who may be unfamiliar with the Imperial system of measurement, 18 inches equals 457mm. The standard gauge of 4ft 8½ ins equals 1435mm. Other dimensions are given only in Imperial measurement, since this will be of most use to model makers.

We wish to thank those people who have been of assistance, far too many to mention individually, and would be pleased to receive any further information on 18" gauge railways.

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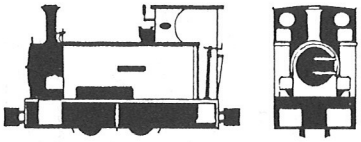

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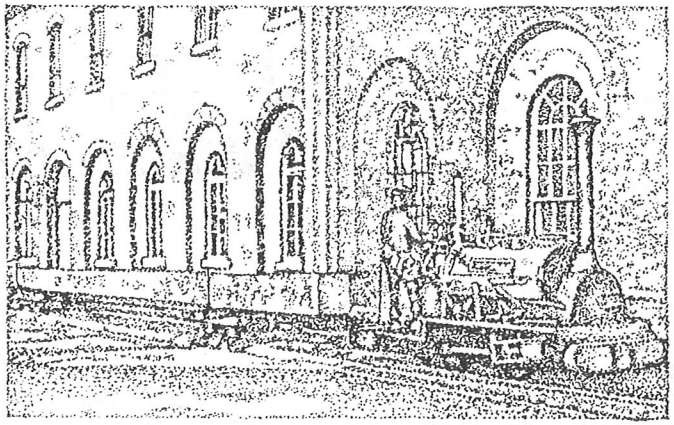
COVER ILLUSTRATIONS - Hornsby Akroyd 0-4-0 "Lachesis"

Horses and Plateways

The first Carriage Master was appointed at Woolwich (then known as "The Warren") on 15th June, 1682. His team of about four horses was hired to convey guns from lighters to the proof-butt and for moving stores generally. Increasing numbers of horses continued to be supplied by various contractors during the years following, stabled at the Warren and used with wagons supplied by the Crown. Arsenal activity grew during the Napoleonic Wars and each of the various Departments became responsible for hire of transport in 1810, establishing arrangements which were later to cause poor railway management.

Attempts to use military horses and dispense with hire contracts were at first a failure but an instruction issued in 1828 virtually ended all hiring, unless specially sanctioned in emergency. A primitive tramroad of flanged, cast-iron plates was installed through the principal storehouses down to the shot-piles about 1824, along which trucks could be pushed by hand or drawn by horses. An extended system was built soon afterwards by Messrs John Hall & Sons, who also cast two sets of wheels/axles.

A further eight "carts for the iron railway" were manufactured by the Royal Carriage Department. The track gauge was probably about 2ft 6ins to 3ft. Each Department still owned its track in 1850 and they refused to co-operate with each other in any way. A wooden tramway was built about this time to transport timber from the wharf to the saw mill, worked by convicts. A connecting line was laid into the adjacent Royal Woolwich Dockyard in 1850. Final tramroad extensions were done about five years later, after which the completed "Royal Arsenal Railway" was placed under the Royal Engineers.



"Lord Raglan" hauling a massive timber baulk on swivelling bogies during the 1870's. Typical loads were much smaller.

The 18 inch gauge System

Orders given in 1866 for construction of an 18" gauge railway followed years of unhurried consideration about how best to improve Arsenal transport with steam haulage, for which the iron tramroad was quite unsuitable. The exact gauge was influenced by Webb's London & North Western Railway Crewe Works tramway, which was cheap and flexible in operation. A standard gauge line would have required major alterations to existing buildings and was not considered necessary for the relatively small loads which then had to be moved over short distances.

Adoption of such a very narrow gauge was later to prove most inconvenient. Not only did standard gauge have after all to be installed extensively to cope with increased loads, but also complex and expensive operation with mixed gauge track continued over many years. The new 18" gauge line first operated on January 10th 1873, extending from the West Wharf to the rear of the Shell Foundry (about half a mile). Track was specially designed by Major PH. Scratchley of the Royal Engineers, having been developed earlier for use at Chatham where horses and carts also used the tramway route.

The track was assembled from cast-iron slabs with grooves for wheel flanges and a chequered surface to help the horses
* grip. Each 4ft long section was bedded into concrete instead of ballast. Although at first interlocked, no joining was in practice required and even broken plates were found to work satisfactorily without need for repair. Pointwork was similarly made, having small forged blades which were pushed over by hand with a piece of wood and could be lifted out to clear any dirt or obstruction. Heavy wear of the crossings (frogs) was overcome
* by inserting small forged "X" pieces, over which the wheel flanges rode. The minimum radius of curve was 25ft. More conventional track was laid where horses were not used and in due course all the "slab" track became obsolete. It was also found to have a bad effect on the wheels in prolonged use. A few fragments have recently been unearthed at Chatham.

The first locomotive used was "Lord Raglan", a cabless, outside framed 0-4-0 saddle tank built in 1871 by Manning Wardle. It continued in regular use, with some alterations, until after the outbreak of war in 1914. Further similar engines were ordered, the type proving popular around the workshops. Some had differing designs of cab. Steam locomotives to a wide variety of designs by other makers were ordered by the various Arsenal Departments as the 18" gauge system expanded. This was a continuation of the horse haulage arrangements which had not been under central control. Only the track was the responsibility of the Royal Engineers throughout. All the

locomotives had outside frames and four coupled driving wheels. By 1880 there were 11 of them working on about 25 miles of track. Trials were conducted with a locomotive made under Mr Crampton's last patents but whatever the results, it was not adopted.

The system developed a timetabled passenger train service to most Arsenal buildings. It ran along a circular, 5 mile long route at frequent intervals. In character it was like the inner circle of the Metropolitan Railway except for a complete absence of tickets or station platforms. A special train of four bogie * carriages (1st, 2nd and 3rd Class) operated between the Main Gate and Eastern end of the Arsenal during the day. Guards were uniformed in a blue frock coat collared in red, leather cross belt and peaked cap. Drivers wore a blue and white suit. Goods traffic was so intensive that a truck could be taken into a shop, loaded and transferred to another section a mile or so away within the hour. A shed was built to house motive power for the Royal Gun Foundry in 1885 at a cost of £1500.

Lieutenant EPC. Girouard of the Royal Engineers was appointed Traffic Manager on 1st January 1891, charged with the duty of runnning the RAR as a unit. He moved into Dial Square, the Arsenal's Officer's Quarters, at a salary of £390 per annum. The Royal Engineers had been organising departmental sections into effective traffic operating divisions prior to this change, ending chaotic traditions and rivalries between them. Lt Girouard started using the RAR as an RE training ground until the Woolmer Instructional Railway (later Longmoor Military Rly) was available. He had in his charge over 1000 items of rolling stock inherited from the various Departments, two thirds of which were 18" gauge. The list of Departments served by the RAR shows the scope of transport work which it performed:

The Ordnance Factories, divided into;

Gun Factory, Carriage Dept, Royal Laboratory (shells, fuses, bombs), Filling Factories, Small Arms Ammunition Factory, Mechanical Engineering Dept, Building Dept.

Inspection Dept, Naval Ordnance Dept, Army Ordnance Dept Research Dept, Proof & Experimental Dept, Chemical Inspection Dept.

Large areas of the Arsenal were covered by Ordnance Stores, Magazines and Proof Butts. RAR locomotives served the adjoining Royal Woolwich Dockyard system. Although ship building ceased in 1869, it became a W.D. store which grew to huge size by 1921.

Locomotives with safety features

Coal fired steam locomotives would have been extremely hazardous if used in filling factories, magazines or timber yards. Some interesting and unusual forms of motive power were tried on the RAR at various times to overcome risk of fire or explosion in these locations. A Beaumont atmospheric locomotive operated for a short while in the 1880's. It was very troublesome and often had to be towed back to its shed, only persevered with at all because nothing better was available. "The Locomotive" magazine described it as a four cylinder compound, in which air was successively expanded down from an initial pressure of 1,000 lb per sqare inch.

A later innovation in "safe" motive power was a definite improvement over the Beaumont machine, though no less curious. This internal combustion 0-4-0 was the first of five Hornsby Akroyd oil engines built at intervals up to 1904. The later four were 2-4-0 wheel arrangement with lengthened frames. Apart from one other example (also for the Military), these were the only locomotives fitted with this early kind of diesel engine. They developed 9½ or 15 brake horsepower, using about a gallon of fuel per hour, and were said to have been audible when at work from up to a mile away. The names given by the Arsenal do not seem to have been carried on the usual plates, unless fixed somewhere which would not show in photographs. Although underpowered and much less than ideal, they continued in use until oil firing of steam engines could effectively replace them in 1915.

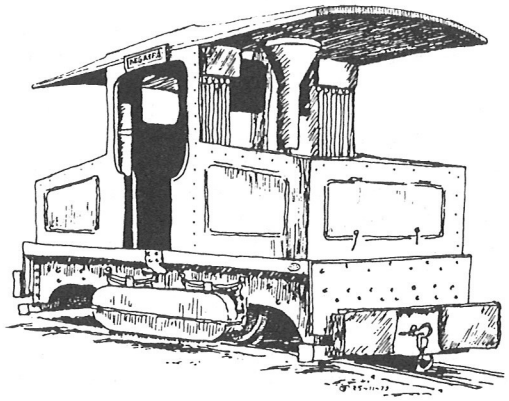
The first new locomotive equipped with oil firing was a * Kerr Stuart 0-4-0ST, named "Petrolea" after Holdens Great Eastern Railway locomotive, in 1914. Various petroleum products were tried including "Anglo-Mexican fuel oil", mixed "creosote oil and dehydrated gas tar", and "diesel engine oil". This was done with Holden, Lucal and Kermode burners, the latter being most widely adopted in narrow gauge locomotives.

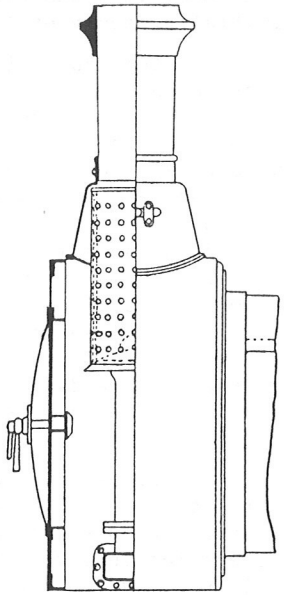
One of the Hornsby Akroyd engines was almost certainly replaced in 1914 by a 40 Horsepower petrol locomotive built about 1911 by McEwan, Pratt. This is thought to have worked on a 20" gauge line at Siemens Bros & Co Ltd telegraph cable works in Woolwich, until requisitioned. Regauging to 18" and flameproofing was done by Baguley (who gave it their number 630). The name "Megaera" was bestowed by the Arsenal and carried on plates fixed above the central cab entrances.

Engines of the Hudswell Clarke "Culverin" class were fitted with spark arresters patented by Mr Neath (the Locomotive Dept foreman), with a wide chimney base to suit. This would not have been sufficient protection from sparks to permit coal fired

engines to work in danger areas. The Avonside side tanks had American style "umbrella" spark arresters, though in this case all were oil fired when new and therefore should not have suffered from spark emission. A similar type of spark arrester was carried by a later development of the "Lord Raglan" type, "SUNBEAM", at Chatham.

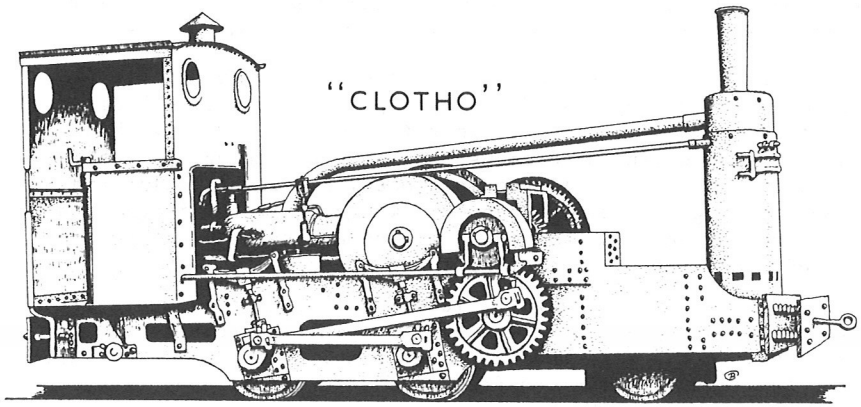
A final solution to the flameproofing requirement came as an incidental benefit of adopting diesel haulage, though the 18" gauge had by then been reduced to a comparatively vestigial remnant. This still served explosives handling areas until it went out of use entirely.





Above: McEwan Pratt 4w petrol engine "MEGAERA" as altered by Baguley for the Royal Arsenal.

Right: "Neath" spark arrester



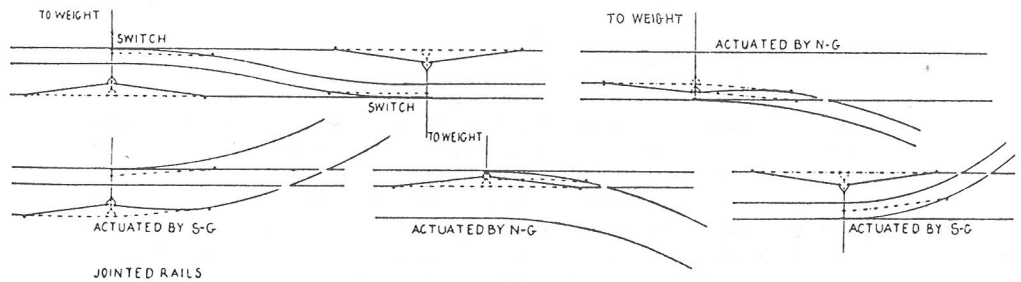
Mixed gauge Track

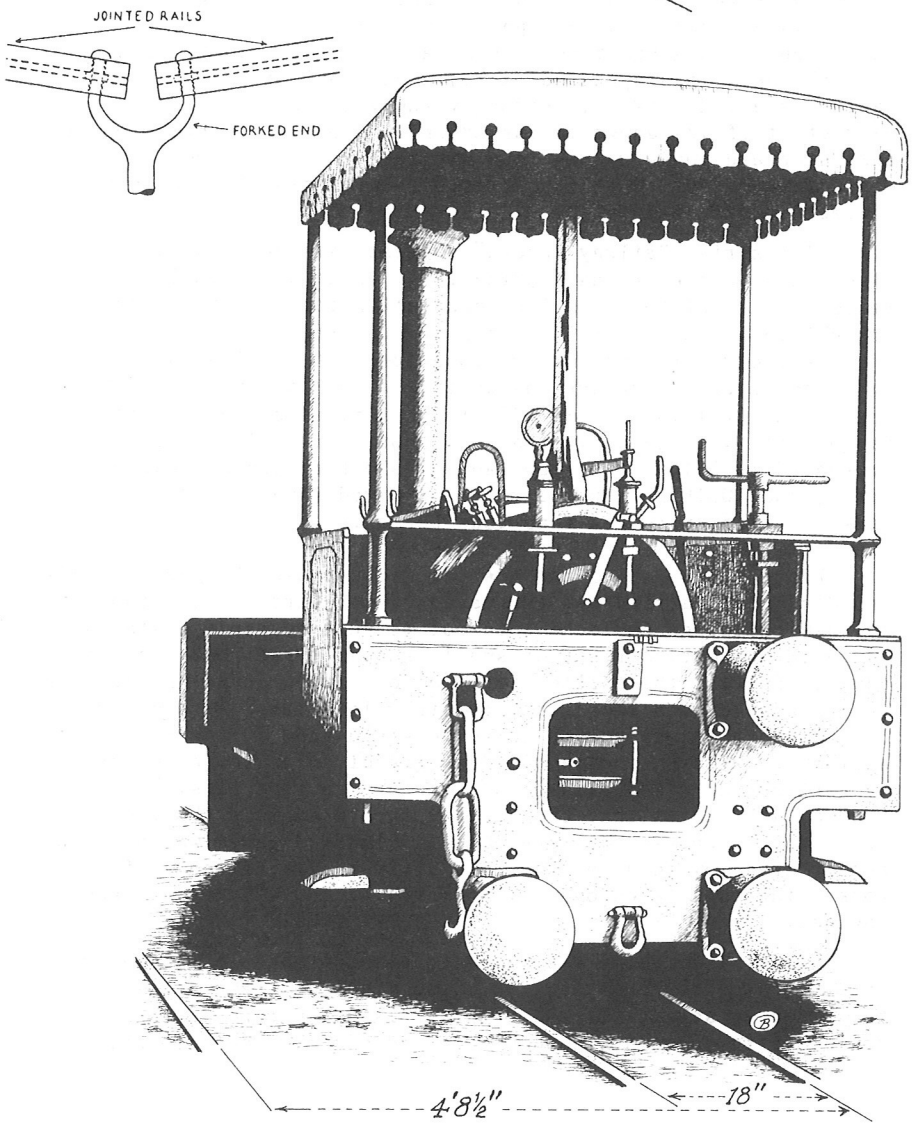
Having decided to adopt 18" gauge for internal traffic, the Arsenal required a transhipment siding from the standard gauge London, Chatham and Dover Railway. This entered W.D. property through a hole in the defensive wall, into the Southern side of the Arsenal at Plumstead. A canal was crossed by a swing bridge before the 18" gauge was met at a coal dock at the eastern end of the west wharf. "The Engineer" published engravings showing an 18" gauge locomotive equipped for hauling standard gauge wagons on mixed gauge track, using a third rail placed outside the 18" ones. This appeared in September 1871 (before "Lord Raglan" started work). It strongly suggests that even from the very start of 18" gauge in the Arsenal, there were intentions to take standard gauge wagons into at least some Departments via mixed gauge track. Much labour required for transhipment could thereby be dispensed with.

"Industrial Railway Record" suggests standard gauge was first laid in the Arsenal during 1870, which would imply immediate use of the main line connection for more than just transhipment, when installed. Mixed gauge track was progressively extended into various areas of the Arsenal and a standard gauge locomotive was bought to work on this in 1890. From then until 1918, some 120 miles of mixed or wholly standard gauge track were laid. Typical flat bottomed rail weights increased to 56lb for narrow gauge, 75lb for standard gauge or mixed, and 105lb for the 25 miles of mixed gauge Gun Roads. These carried up to ten tons load per axle.

Later expansion of the Arsenal did not use 18" gauge. Loads and distances carried had increased beyond narrow gauge capacity, and new buildings could be laid out to suit access for standard gauge throughout. A fleet of small, rubber tyred road vehicles came to fulfill the earlier function of narrow gauge in carrying tiny loads between shops or into tight locations. A second main line connection was put in to the eastern area during the First World War, with extensive sidings. The circular route referred to earlier was also followed by standard gauge trains. "The Locomotive" states that the Hornsby Akroyd engines (by then about to be superseded) were hauling standard gauge wagons into danger areas by means of special "divider" trucks, some of their work being then taken over by standard gauge, oil fired steam engines.

A policy decision was taken to abandon most 18" gauge in 1923, much of the remaining 50 or 60 miles of track being recovered as scrap. All the complex mixed gauge pointwork was taken out to ease maintenance work and minimise derailments.





1914-18 and gradual Post-War decline

Although the Arsenal had 45 18" gauge locomotives at the outbreak of war in 1914, they were a combination of ten "classes" and many were in poor condition due to age or bad maintenance. Engineer's records note, for example, that some boilers had filled with a solid lime deposit (from feed water) to a depth of 13" in front of the firebox tubeplate. As large numbers of new locomotives arrived to cope with increased war traffic, the opportunity was taken to standardise on a smaller number of types. The older examples were kept in reserve until hostilities ended. All Arsenal railways came under civil control with the appointment of Mr FW. Turner (a Great Eastern Railway engineer from Stratford Works) as traffic manager in 1921.

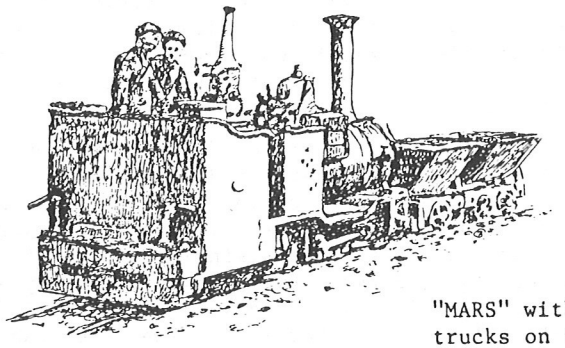
During the early 1920's, as the 18" gauge was abandoned wholesale, up to 20 or 30 engines were often advertised for sale at once. This included many which were nearly new but their very narrow gauge meant most were scrapped by the purchaser. Rolling stock was similarly rationalised with the introduction of standard types of bogie stock (having sprung buffers) and four-
* wheeled underframes (dumb buffers). By 1918, much production work had been transferred away from the Arsenal to dispersed locations and this certainly limited the usefulness of 18" gauge notwithstanding investment in new equipment which had just been made. It is not clear exactly why some lines were retained to feed magazines but provision of new diesel locomotives to work them indicates a definite need.

The articulated Hunslet diesel "Albert" was built in 1934 and at least four standard Ruston & Hornsby machines arrived to handle Second World War traffic 1939 - 41. This was not very great and only four steam engines (all Avonsides) were retained, one in a dismantled state. Surprisingly in view of diesels having been provided, Bagnalls were asked to supply an 0-4-0 saddle tank in 1941. This was to have 7" x 12" cylinders and 1' 9½" wheels (allocated number 2636). The order was cancelled before construction so this locomotive never existed.

The last narrow gauge engine arrived as late as 1954. It
* was another articulated Hunslet diesel, "Carnegie". Sole surviving Avonside, "Woolwich" was disposed of soon after in 1959. A period in the Northampton yard of Messr's Pitt of Brackley ended with the engine having her spark arrester removed and a plain chimney fitted before being put into steam on raised blocks, by J&W. Gower of Bedford. She left two days later on 11th April, 1962 on a lorry to Bicton Gardens in Devon. A line was built there, where she still runs. Before repainting, it was noted that the Arsenal livery had been green lined with yellow. She seemed to have been reboilered as little as five years earlier.

"Carnegie" was sold to F&J. Dartnell of North Ockenden, Essex. She was tracked down and rescued from their yard in 1966 to join "Woolwich" at Bicton. Photographs taken in the Arsenal during April, 1970 show the very last 18" stock collected on an overgrown mixed gauge (three rail) track, where they and the Rustons had evidently languished out of use for considerable time. All were disposed of in 1971. Several bogie underframes (used for rebuilding as coaches), a complete bogie wagon and a complete hay wagon went to Bicton with a Ruston. The latter was rebuilt with a box body and cab and looks drastically different.

A four-wheel gunpowder van was privately purchased for preservation, at Sittingbourne and more recently in a museum at Bettws-y-coed. The early Vulcan Foundry 0-4-2T "Mars" stayed at Longmoor to heat hot water for the camp bath house until placed on a plinth in 1924. Unfortunately, it was reduced to just the sectioned boiler for instructional purposes by 1930. This curious and sadly incomplete relic is preserved now at the Army Transport Museum, Lecomfield, Humberside.



"MARS" with ballast trucks on the Weavers Down Tramway

Suggested further reading

"Technical Study of the Festiniog Railway and some other Narrow gauge Railways in England" E. Vignes, 1878 (translated text, "Merioneth Mercury" No 25 Spring 1982).

"The Royal Arsenal" (Volume 2) OFG. Hogg, Oxford University Press 1963.

"The Locomotive, Railway Carriage & Wagon Review" October 1921.

"Industrial Railway Record" No 95,53.

Minutes of Proceedings, Institute of Mech. Engineers 26 July 1898 "Narrow Gauge Railways of 2ft and under".

R.A.R. Locomotive Dimensions

The following table has been compiled from various incomplete published details, which sometimes conflict. It was decided to include them as a guide for model makers. With the exception of "AJAX" and "RCD3", the details also apply to other engines of the common classes. Notes on each column are given below.

1) Name allocated by the Arsenal, except "Ruston" identified by maker.

2) Cylinder diameter and stroke in inches. "LACHESIS" had only one cylinder. The output of the engine of "CARNEGIE" is given in Horsepower. Ruston type detail is given.

3) Wheel diameter. Diameters of idle wheels are not known, except for "MARS" and the Hornsby Akroyd 2-4-0 engines. These were the same as driving wheel diameter.

4) Fixed/coupled wheelbase 7) Width

5) Total wheelbase 8) Weight, tons and hundredweights

6) Length without buffers 9) Height

	1.	2.	3.	4.	5.	6.	7.	8.	9.
	LORD RAGLAN	6 x8	1'8"	3'3"					
	RCD3	7 x9	1'9"	3'9"		13'5"	5'0"	6t14ct	8'6"
	MARS	7½x12	1'8 ¼"					7t14ct	
	CULVERIN	7 x12	2'0"	3'3"				8½t	
	LONDON	7 x12	2'0"	3'3"				8½t	
*	CORMORANT	7 x12	2'0"	3'0"	7'6"				
	SERAPIS	7½x12	2'0 /4"	3'6"				10½t	
	AJAX	7 x12	2'1"	3'3"		13'7½"			7'9"
*	PHAETON	7 x12						9t2ct	
	WOOLWICH	8½x12	2'1"	3'3"		12'10½"	5'4"	11t	8'6"
	CARNEGIE	88hp	1'8"	3'0"	12'0"	18' ¼"	5'1½"	13t15ct	9'0"
	Ruston	20DL	1'4"	2'7"		8'4"	3'5"	3t	
*	LACHESIS	11x15	1'8"	3'6"					

Royal Arsenal Railway 18" gauge Locomotives

The following list has been compiled by the authors from all available sources. Some errors or omissions are likely even after repeated revision. Blanks in any column mean not applicable, or no information found. Engines appear in the sequence they started work at the Arsenal, earlier examples being withdrawn as replacements became available. Abbreviations and notes for each column are explained below.

1) Number allocated by the Arsenal. RCD2 and RCD3 numbered for Royal Carriage Department. RCD3 carried no name when new, only number plates on tank sides.

2) Name allocated by the Arsenal, normally displayed on a standard size pair of cast metal plates for easy recognition by staff.

3) Wheel arrangement. 4w indicates chain drive.

4) Type description, abbreviated as:

ST	saddle tank	IST	inverted saddle tank
CA	compressed air	OM	oil mechanical (semi-diesel)
T	side tank	PM	petrol mechanical
WT	well tank	DM	diesel mechanical

5) Builder, abbreviated as:

MW	Manning Wardle	HA	Hornsby Akroyd
BM	Beaumont	KS	Kerr Stuart
FW	Fox Walker	MP	McEwan Pratt
VF	Vulcan Foundry	AE	Avonside Engine Co
HC	Hudswell Clarke	HE	Hunslet Engine Co
JF	John Fowler	RH	Ruston & Hornsby
WB	W. Bagnall		

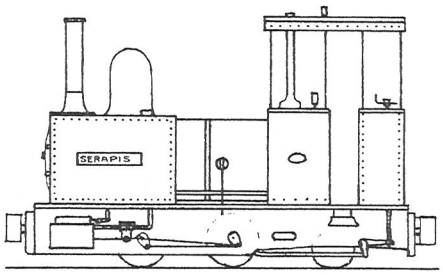
6) Works Number of the builder.

7) Year of building new.

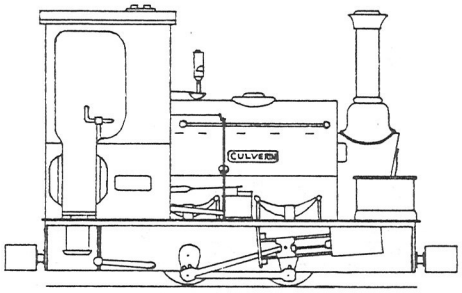
8) Disposal with date where known. X denotes sold or scrapped before 1923. Most "sold" probably were broken up by scrap dealers due to unusual gauge. RAMESES went to Sudan from Woolwich. Line "derelict or in disrepair" 1904 and loco photographed dug out of sand when track relaid to 60cm gauge, found at fort El Teb c1920. MEGAERA was derelict at Alpha Cement Ltd Rodmell Works by 1927, probably having worked there converted to 2ft gauge. Sold or scrapped c1930.

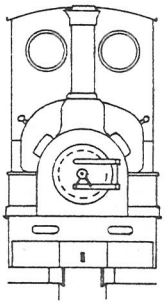
	LORD RAGLAN	0-4-0	ST	MW	353	1871	Scrapped Chatham 1915
	BUSY BEE	0-4-0	ST	MW	424	1872	To Chatham 18??
	BOXER/VICTORIA	0-4-0	ST	MW	477	1873	Sold 11/1916
	ALBERT EDWARD	0-4-0	ST	MW	482	1873	Sold 1919
RL2	ROCKET	0-4-0	ST	MW	555	1875	Scrapped 6/1914
RCD2	NORMAN RAMSEY	0-4-0	ST	MW	605	1876	Scrapped 6/1914
	TRUMPETER	0-4-0	ST	MW	612	1876	Scrapped 8/1915
RL3	SHRAPNEL	0-4-0	ST	MW	613	1876	Sold 11/1916
	VAUBAN	0-4-0	ST	MW	685	1877	Sold 11/1916
	COEHORN	0-4-0	ST	MW	696	1878	Sold 11/1916
	?	0-4-0	CA	BM			Out of use by 1881
RL4	FUSEE	0-4-0	ST	MW	939	1884	Sold Swainswick Colliery 18?
5	GORDON	0-4-0	ST	MW	986	1886	Sold 1919
RL5	TORPEDO	0-4-0	ST	MW	1043	1888	Sold 2/1918
	ARQUEBUS	0-4-0	ST	MW	1130	1889	Sold 11/1916
		0-4-0	T	FW	386	1878	X
RCD3	IRON DUKE	0-4-0	ST	VF	838	1878	Scrapped 1914
	MERCURY	0-4-2	WT	VF	1075	1884	Abandoned Suakin 1886
	MARS	0-4-2	WT	VF	1160	1885	Boiler preserved RACT
	VENUS	0-4-2	WT	VF	1161	1885	Scrapped Longmoor 1907
	CARRONADE	0-4-0	ST	HC	268	1884	X

	CULVERIN	0-4-0	ST	HC	269	1884	X
MED23	ACHILLES	0-4-0	ST	HC	274	1885	Sold 15/2/1921
	HECTOR	0-4-0	ST	HC	273	1885	X
MED25	SCIPIO	0-4-0	ST	HC	280	1885	Sold 15/2/1921
MED26	HANNIBAL	0-4-0	ST	HC	281	1885	Sold 15/2/1921
	BASILISK	0-4-0	ST	HC	288	1886	Sold 15/2/1921
RL6	GRENADE	0-4-0	ST	HC	295	1887	X
	MILITADES	0-4-0	ST	HC	345	1889	X
MED43	OWL	0-4-2	T	JF		1885	Sold 15/11/1920 (5063 or 4)
MED44	OSTRICH	0-4-2	T	JF	5060	1885	Sold 15/11/1920
MED45	CORMORANT	0-4-2	T	JF	5058	1885	Sold 15/11/1920
MED46	QUAIL	0-4-2	T	JF	5061	1885	Sold 15/11/1920
MED47	PELICAN	0-4-2	T	JF		1885	Sold 15/11/1920 (5063 or 4)
MED59	VULTURE	0-4-2	T	JF	5059	1885	Sold 15/11/1920
	FLAMINGO	0-4-2	T	JF	5062	1885	Scrapped Longmoor 4/1919
	OSIRIS	0-4-2	IST	WB	710	1885	Sold 15/7/1919
	SERAPIS	0-4-2	IST	WB	711	1885	Scrapped 1912
	ANUBIS	0-4-2	IST	WB	712	1885	Sold 15/7/1919
	ISIS	0-4-2	IST	WB	713	1885	Sold 1920
	APIS	0-4-2	IST	WB	714	1885	Sold 15/7/1919
MED51	AJAX	0-4-0	IST	WB	1442	1895	Sold 15/2/21
	RAMESES	0-4-0	IST	WB	1452	1896	To Tokar Trinkitat Rly, Sudan
	LACHESIS	0-4-0	OM	HA	1705	1896	Sold 10/1918
	CLOTHO	2-4-0	OM	HA	4535	1900	Sold 10/1915
	ATROPOS	2-4-0	OM	HA	5245	1901	Sold 11/1917
	PLUTO	0-4-0	ST	KS	761	1901	Sold (Erith) 1921
	POLUMEPHUS	0-4-0	ST	KS	762	1901	X
	PHAETON	0-4-0	ST	KS	763	1901	Sold (Erith) 1921
	HECTATE	2-4-0	OM	HA	5883	1902	Sold 1/9/1919
	PEGASUS	0-4-0	ST	KS	807	1902	Sold (Erith) 1921
	PROMETHEUS	0-4-0	ST	KS	808	1902	Sold 1921
	PHOENIX	0-4-0	ST	KS	809	1902	Sold 1921
	ALECTO	2-4-0	OM	HA	7226	1904	From Chatham. Sold 10/1918
	REGULUS	0-4-0	ST	KS	1266	1912	X
	POMPEY	0-4-0	ST	KS	1267	1912	X
	BRUTUS	0-4-0	ST	KS	1268	1912	X
MED77	MEGAERA	4w	PM	MP		c1911	Requisitioned 1914. Sold 15/11/20
	PETROLEA	0-4-0	ST	KS	2400	1914	X First oil fired.
	LONDON	0-4-0	ST	HC	1144	1915	X
	CARNARVON	0-4-0	ST	HC	1145	1915	X
	KENT	0-4-0	ST	HC	1146	1915	X
	CORNWALL	0-4-0	ST	HC	1147	1915	X
	ESSEX	0-4-0	ST	HC	1148	1915	X
	BRISTOL	0-4-0	T	AE	1715	1915	X
	GLASGOW	0-4-0	T	AE	1716	1915	X
	LIVERPOOL	0-4-0	T	AE	1717	1915	X
	NEWCASTLE	0-4-0	T	AE	1718	1915	Scrapped 1951
	DERBY	0-4-0	T	AE	1747	1916	X
	WOOLWICH	0-4-0	T	AE	1748	1916	Sold 1959, to Bicton 1962
	WALTHAM	0-4-0	T	AE	1749	1916	X
	BIRMINGHAM	0-4-0	T	AE	1750	1916	X
	SHEFFIELD	0-4-0	T	AE	1751	1916	X
	CHARLTON	0-4-0	T	AE	1752	1916	X
	LEEDS	0-4-0	T	AE	1753	1916	X
	MANCHESTER	0-4-0	T	AE	1754	1916	Condemned 1947
	COLCHESTER	0-4-0	T	AE	1755	1916	Scrapped 1954
	CARDIFF	0-4-0	T	AE	1756	1916	X
	BERKELEY	0-4-0	T	AE	1757	1916	X
	ENFIELD	0-4-0	T	AE	1758	1916	X
	ALBERT	0-4-4-0	DM	HE	1722	1934	Scrapped 1961
		4w	DM	RH	192885	1939	Sold ? 1971
		4w	DM	RH	192886	1939	Sold 1971
		4w	DM	RH	213839	1941	To Bicton
		4w	DM	RH	213840	1941	Sold 1971
	CARNEGIE	0-4-4-0	DM	HE	4524	1954	To Bicton 1966

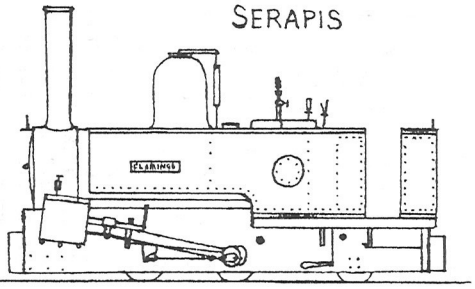


SERAPIS

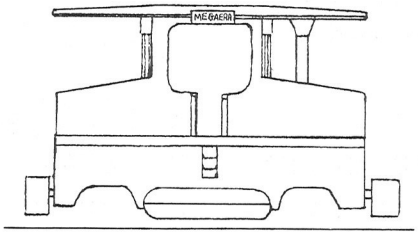




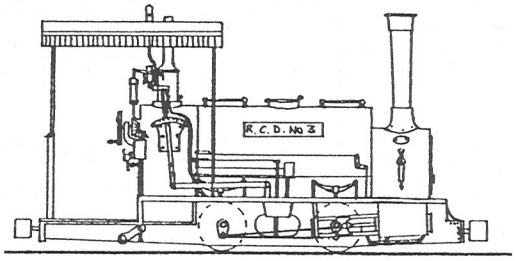
CULVERIN



FLAMINGO

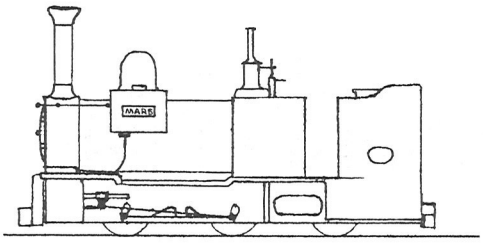


MEGAERA

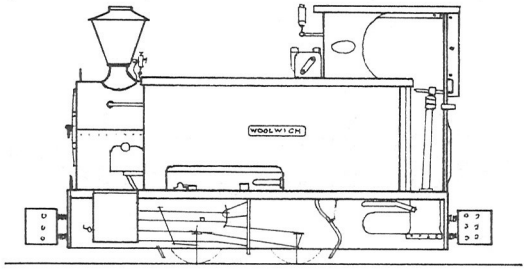


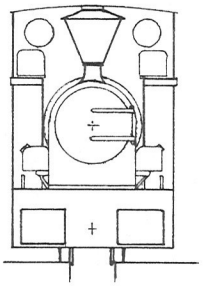
R.C.D. Nº3

14.

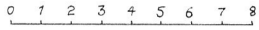


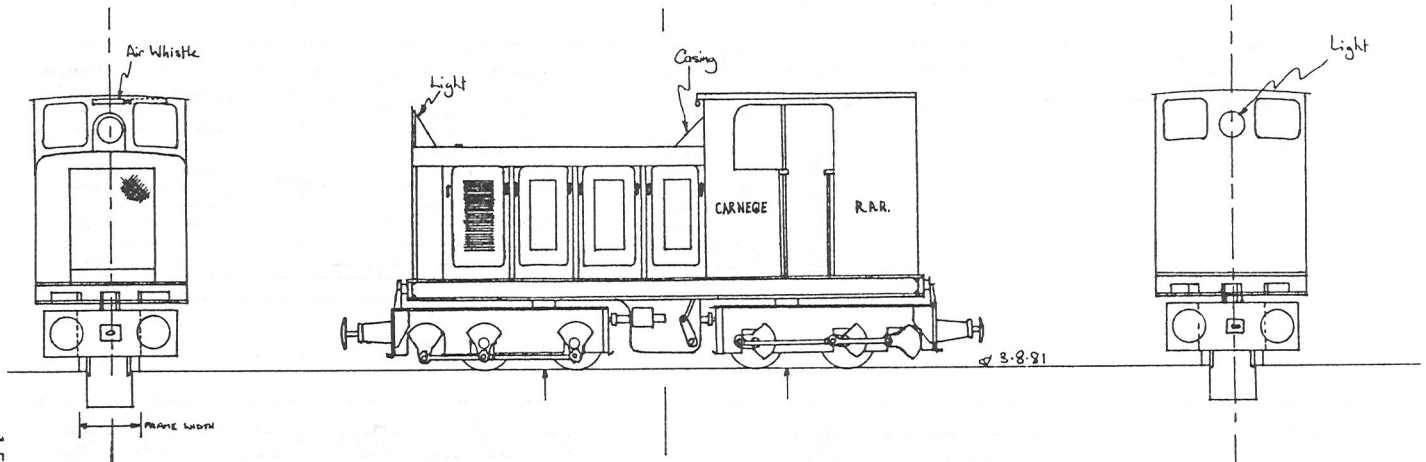
MARS





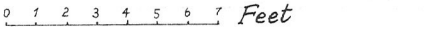
WOOLWICH

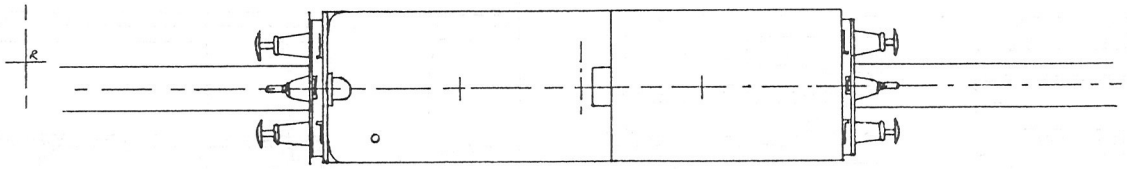


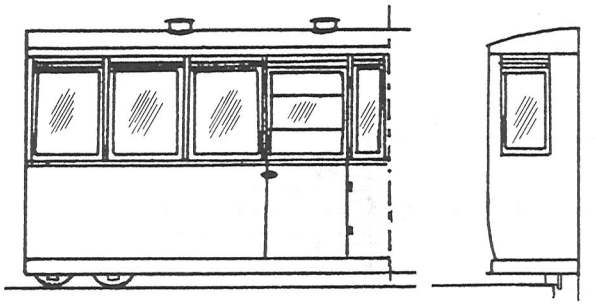


15.

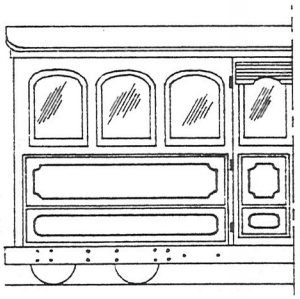
HUNSLET CARNEGIE



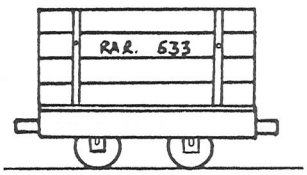




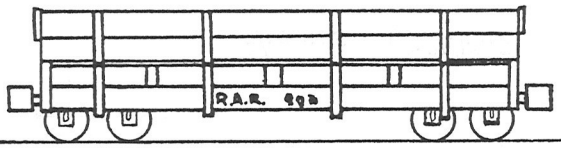
3RD CLASS BOGIE COACH



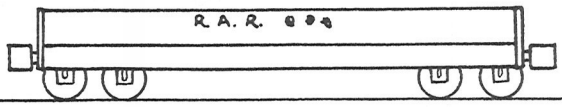
SALOON



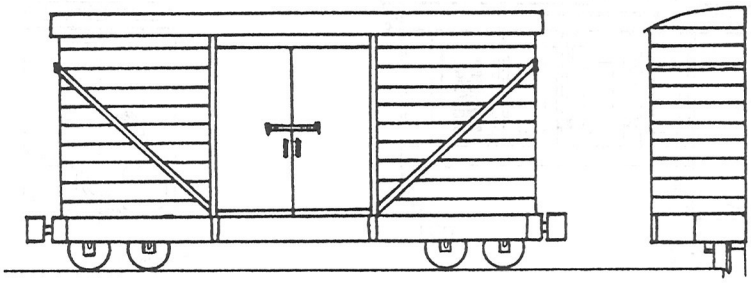
4 PLANK OPEN



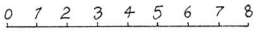
2 PLANK DROPSIDE BOGIE OPEN

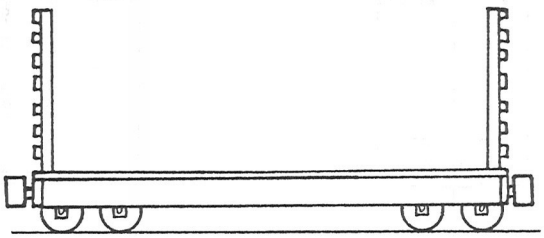


1 PLANK BOGIE OPEN



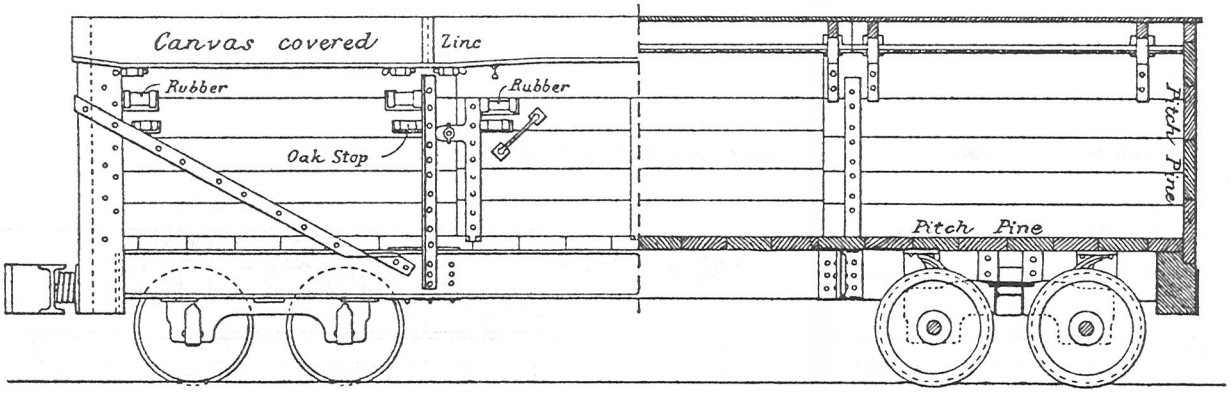
BOGIE VAN



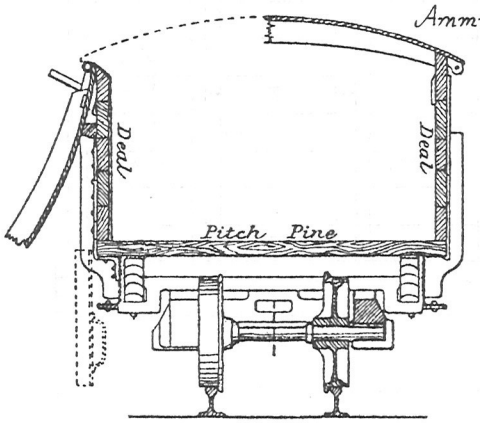


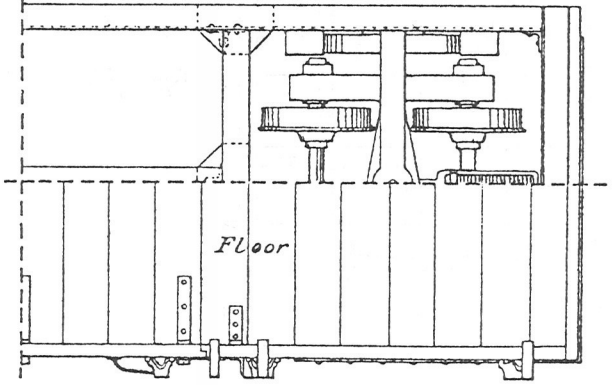
BOGIE FLAT WITH SLATTED ENDS

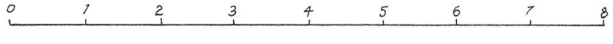
16.



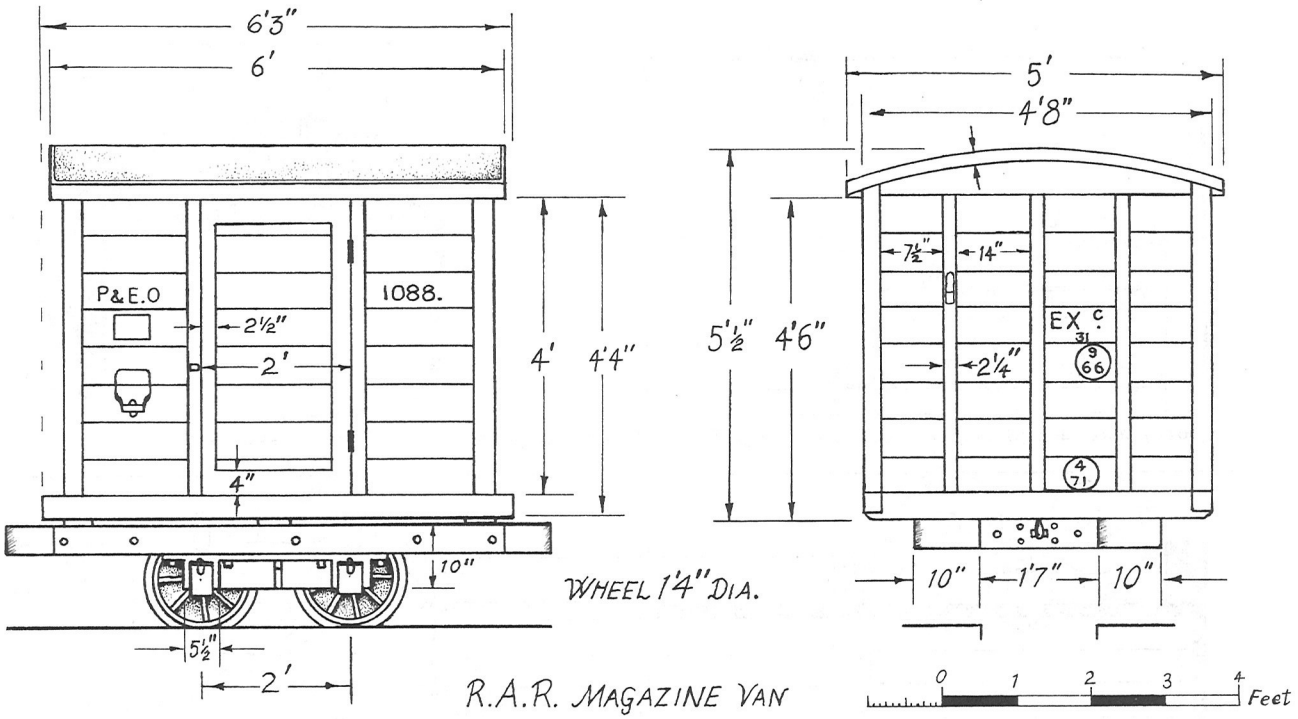
Ammunition van in use by 1898. Cast-iron bogies (4 ton axle load)



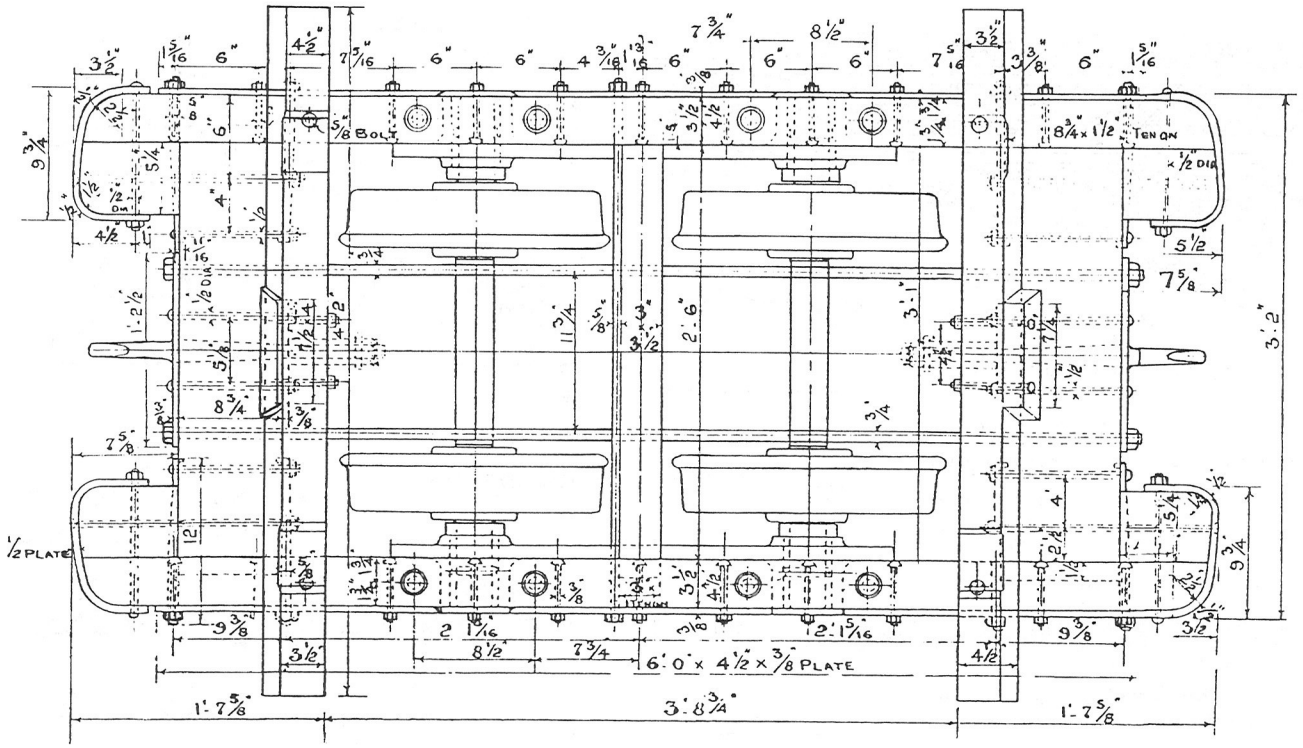




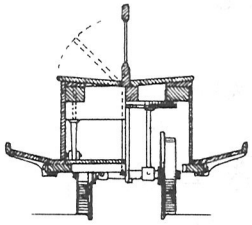
17.

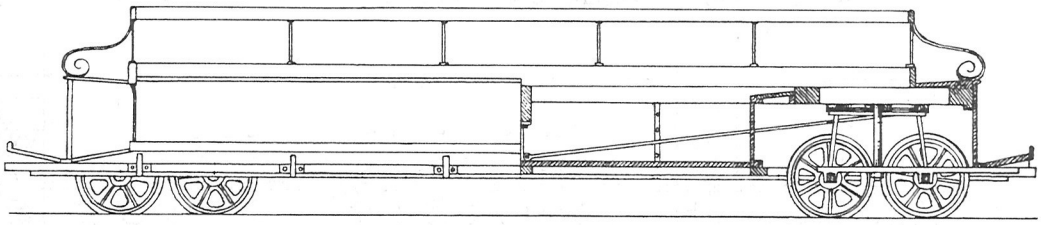


R.A.R. MAGAZINE VAN



R.A.R. STANDARD 4 WHEEL WAGON UNDERFRAME, PLAN VIEW

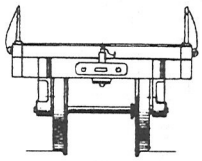


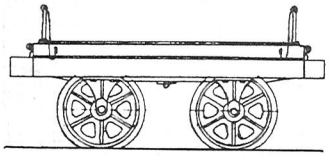


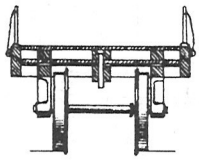
Below: Flat wagon with swivelling top. Note one wheel left free on axle.

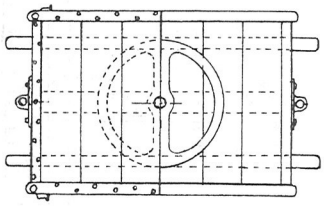
R.A.R. EQUIPMENT OF THE 1870's

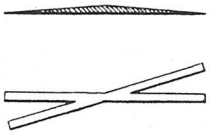
Above: 30 seat, open 3rd Class coach. Later types varied in construction. All were scrapped by about 1920.





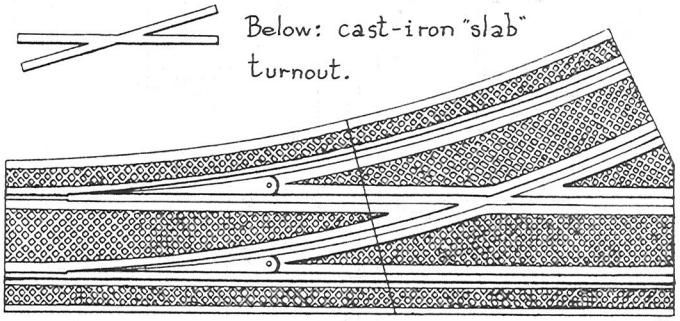


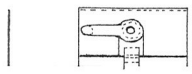




Left: Forged crossing insert.

Below: cast-iron "slab" turnout.

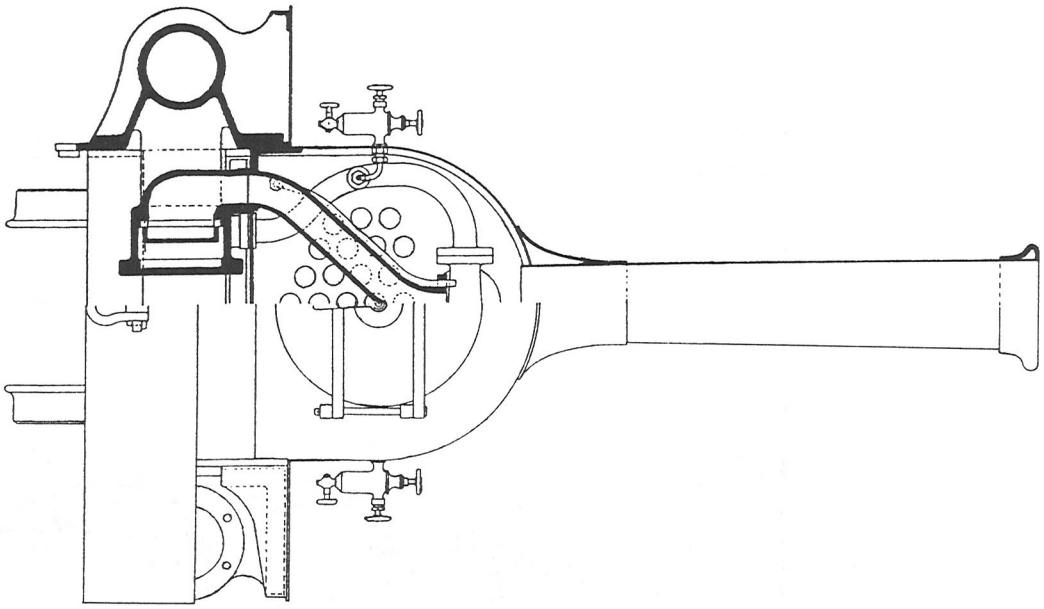


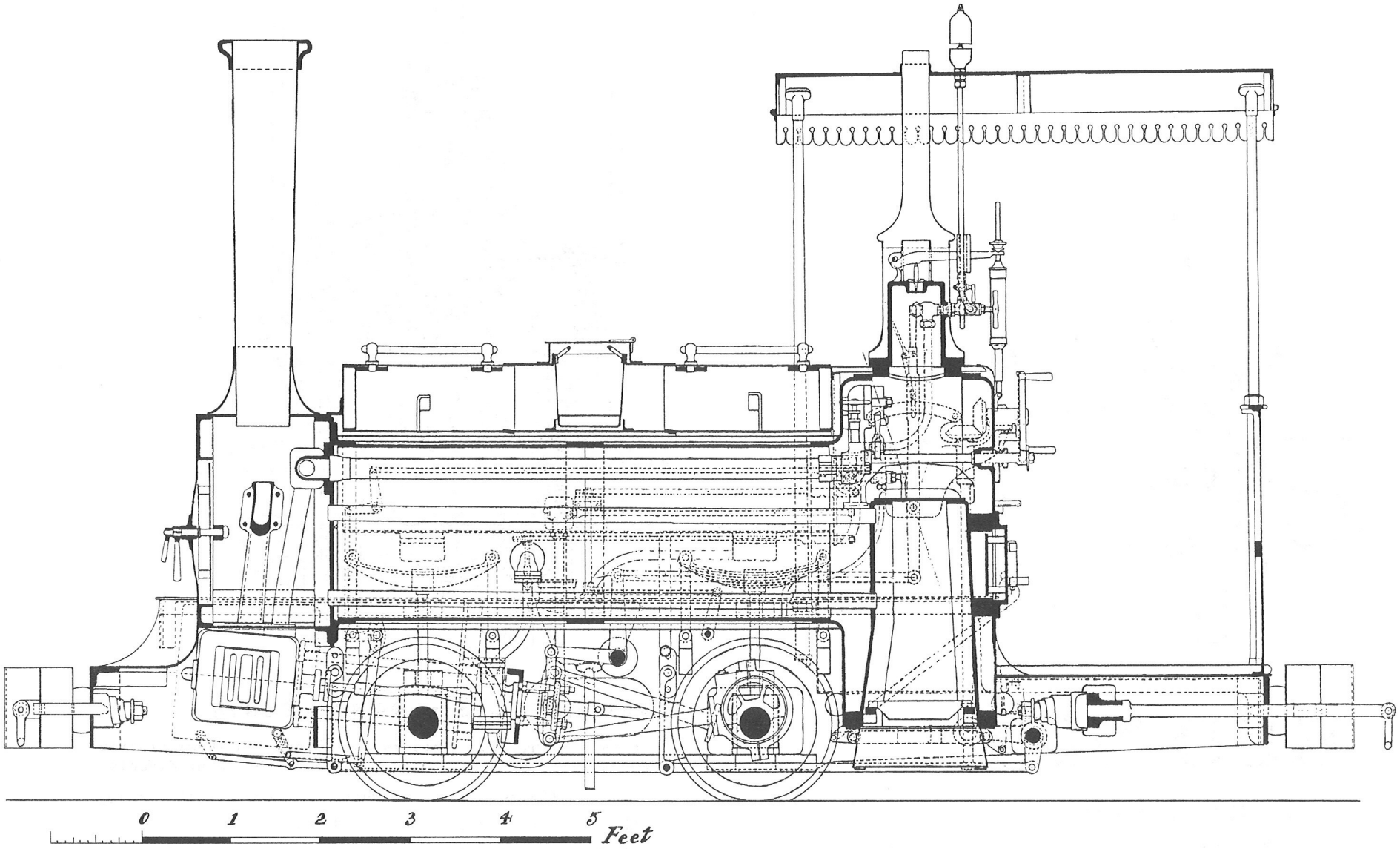


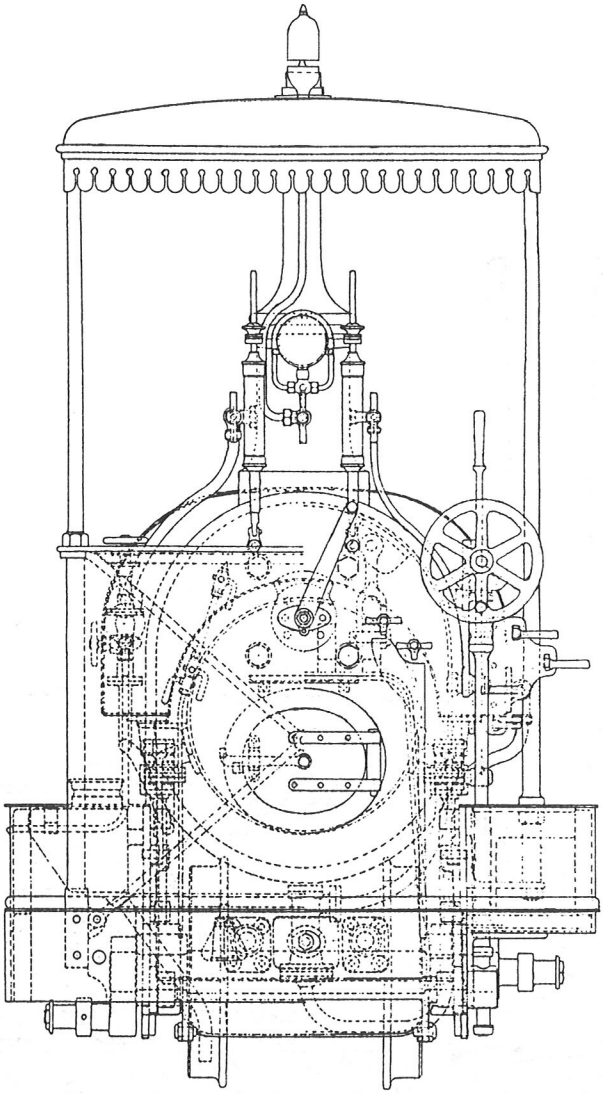
RCD No 3

IRON DUKE

RAR Woolwich




0 1 2 3 4 5 Feet

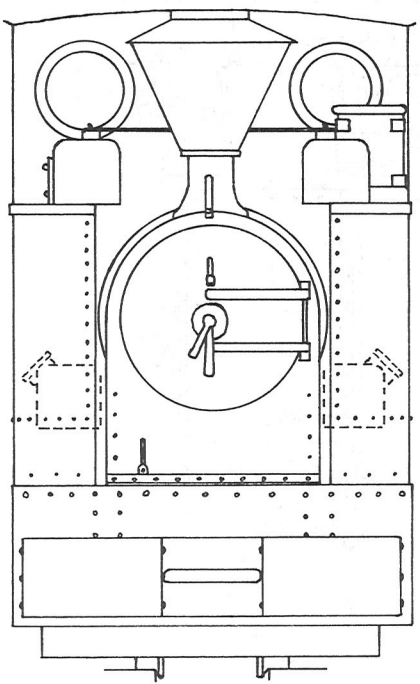


Vulcan Foundry Nº 838 of 1878

Works drawings show interesting changes in wheel profile and spacing from this early engine to the later diesels.

	Between wheels	Wheel thickness (with flange)
RCD 3	1' 3 3/4"	3 3/4"
ALBERT	1' 3 7/8"	4"

ROYAL ARSENAL RAILWAY

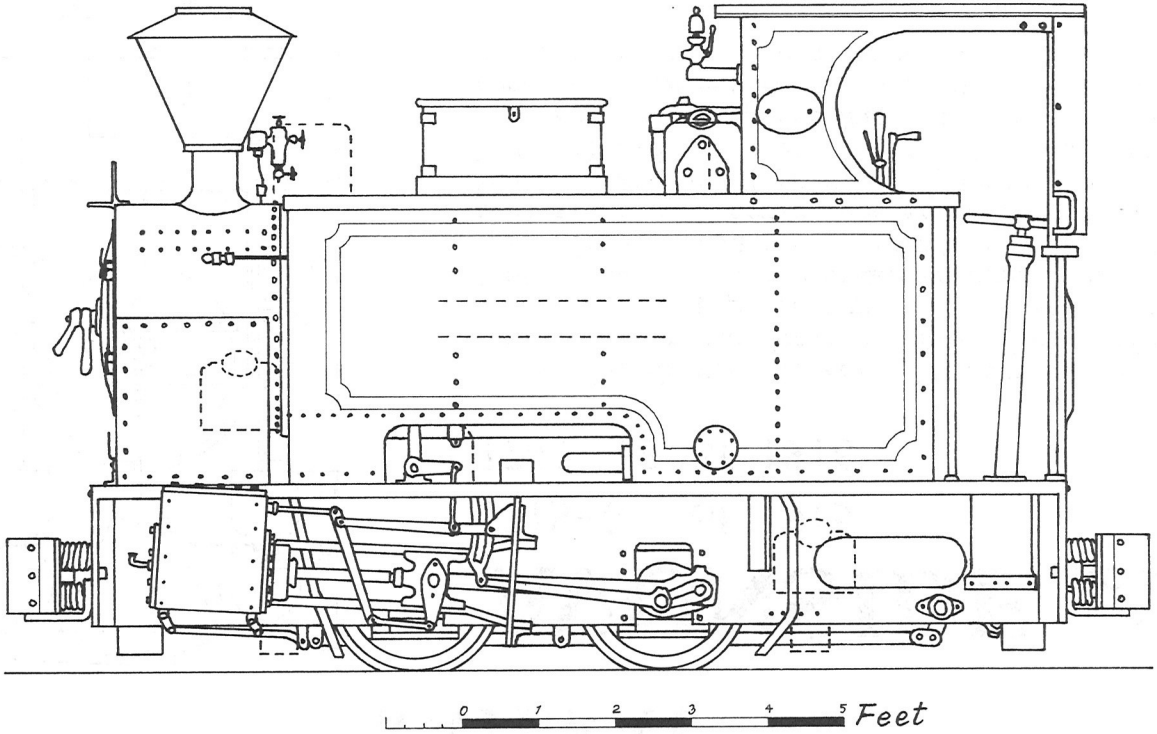


AVONSIDE ENGINE CO.

1715-8 of 1915

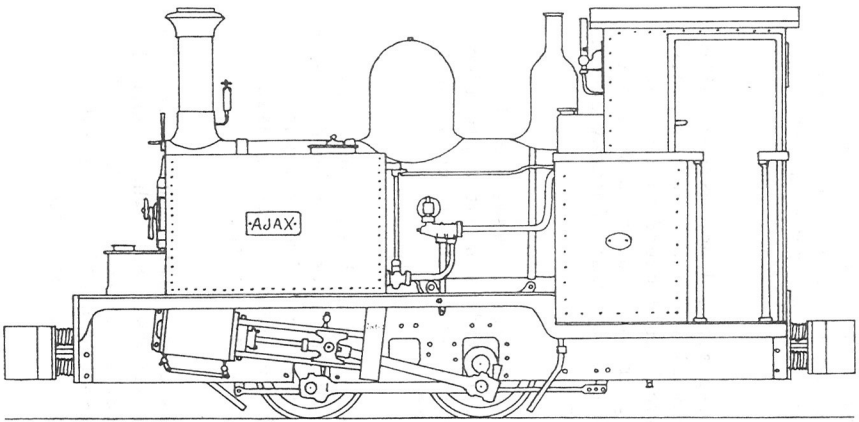
1747-58 of 1916

The scaled drawing is not of a particular locomotive but shows various details featured at different times, noted on photographs. The first four had small tank cutouts, the remainder longer. Rear sand boxes were fitted below the footplate but first rear and then front sand boxes were moved to the tank tops. "Manchester" and "Woolwich" (probably others also) had enclosed cab backs."Sheffield" and "Derby" in passenger carrying use had tool boxes on their tank tops and open cab backs above waist height. Lining out was identical on all the Avonside engines.


0 1 2 3 4 5 Feet

W.G. Bagnall

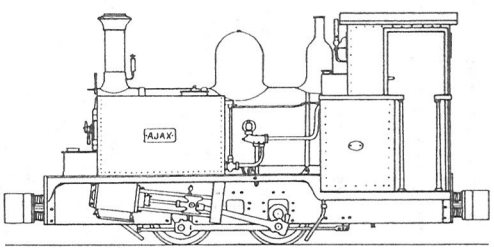
Nº 1442 of 1895

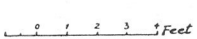


AJAX

R.A.R.

WOOLWICH





Full page R.A.R. Locomotive Illustrations

Particularly noteworthy features of each engine are mentioned below, with remarks relating to others of the same class where likely to be useful. For further details and dimensions, see pages 11 to 13.

"RCD No 3" Vulcan Foundry. The footplate did not extend fully to the front buffer beam. It is unusual to place a works plate on the smokebox side, which may have been decided by complete absence of cab side sheets. Leading crankpin brasses were not split, so could not be adjusted to take up wear. Chimney cap and safety valve "trouser" were polished.

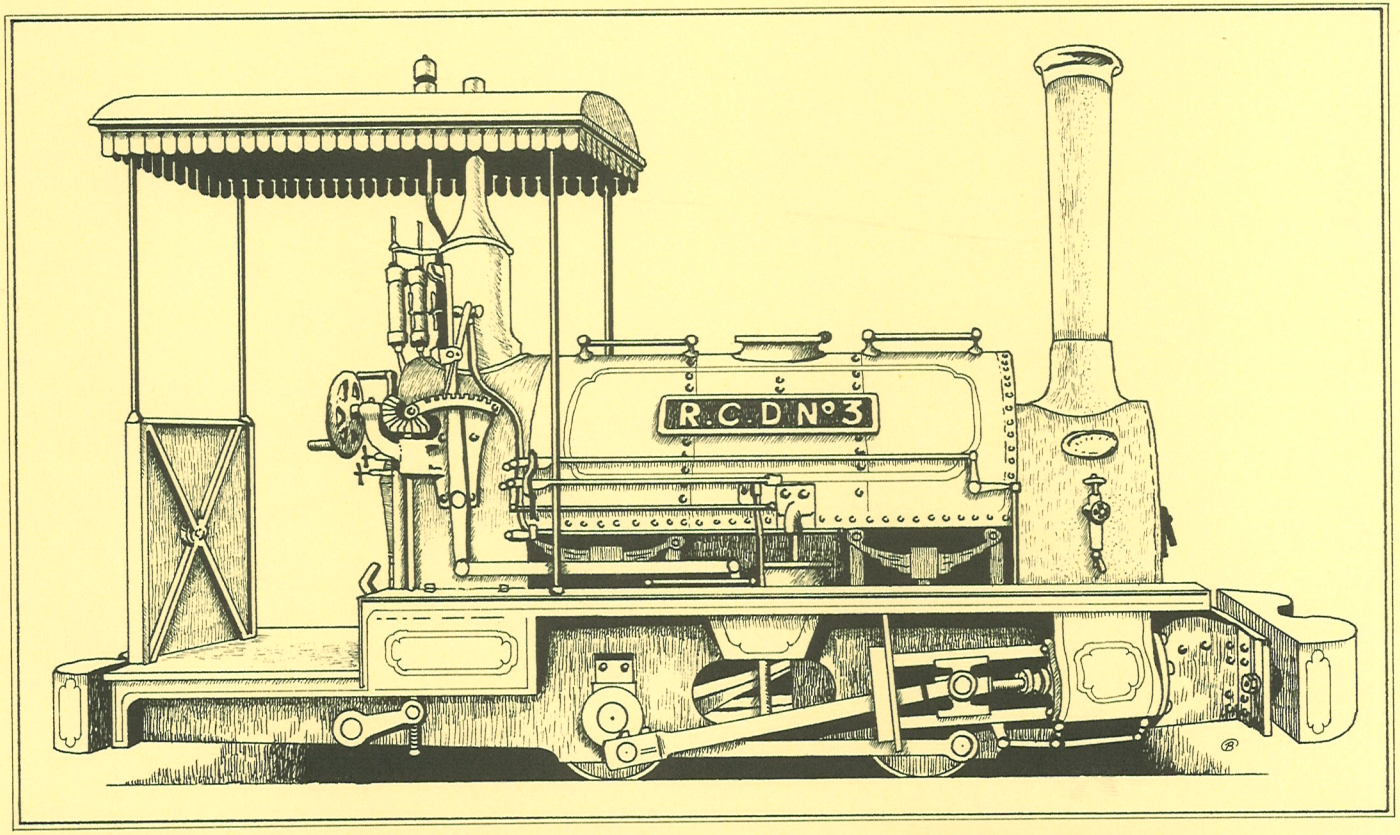
"OSTRICH" Fowler (shown without name plates). Valve gear had vulnerable return cranks, partly protected by stout angle iron beams bolted to the frames underneath. Note hinged access door through the frame, in line with firebox.

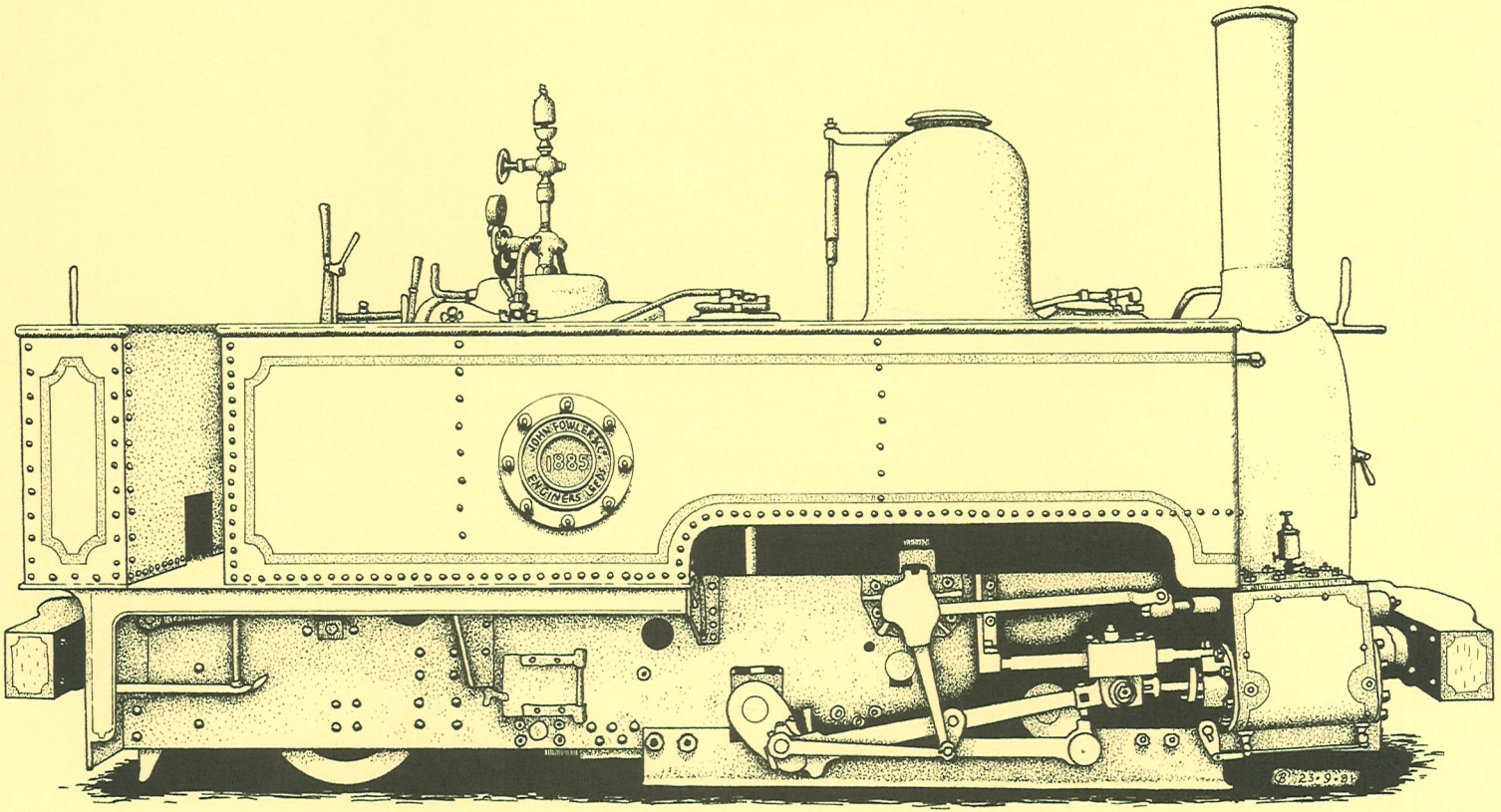
"CORMORANT" Fowler. Cylinders were raised high so connecting rods could work in line with the coupling rods to reduce risk of fouling trackside obstructions. Stephenson valve gear was carried between the fly cranks and the frames. Driving axle journals had a spring equilising beam beneath them.

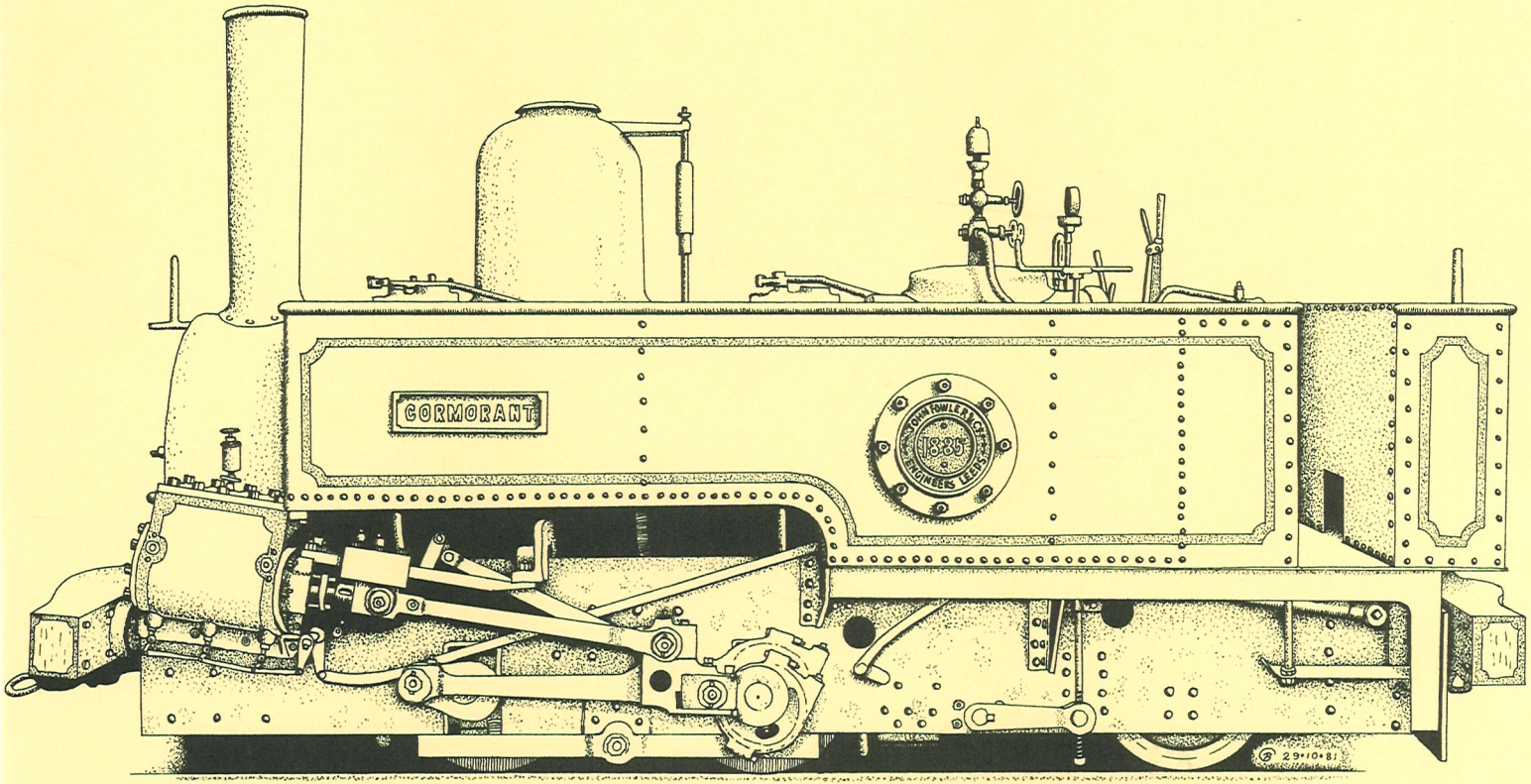
"MARS" Vulcan Foundry. The name plate was carried on a sand box. Water tanks were at the rear. A horizontal brake wheel worked through bevel gears on the far side, as shown on "RCD No 3". Whereas "VULCAN" had a polished dome and plain topped chimney, "MARS" had a painted dome and polished chimney cap.

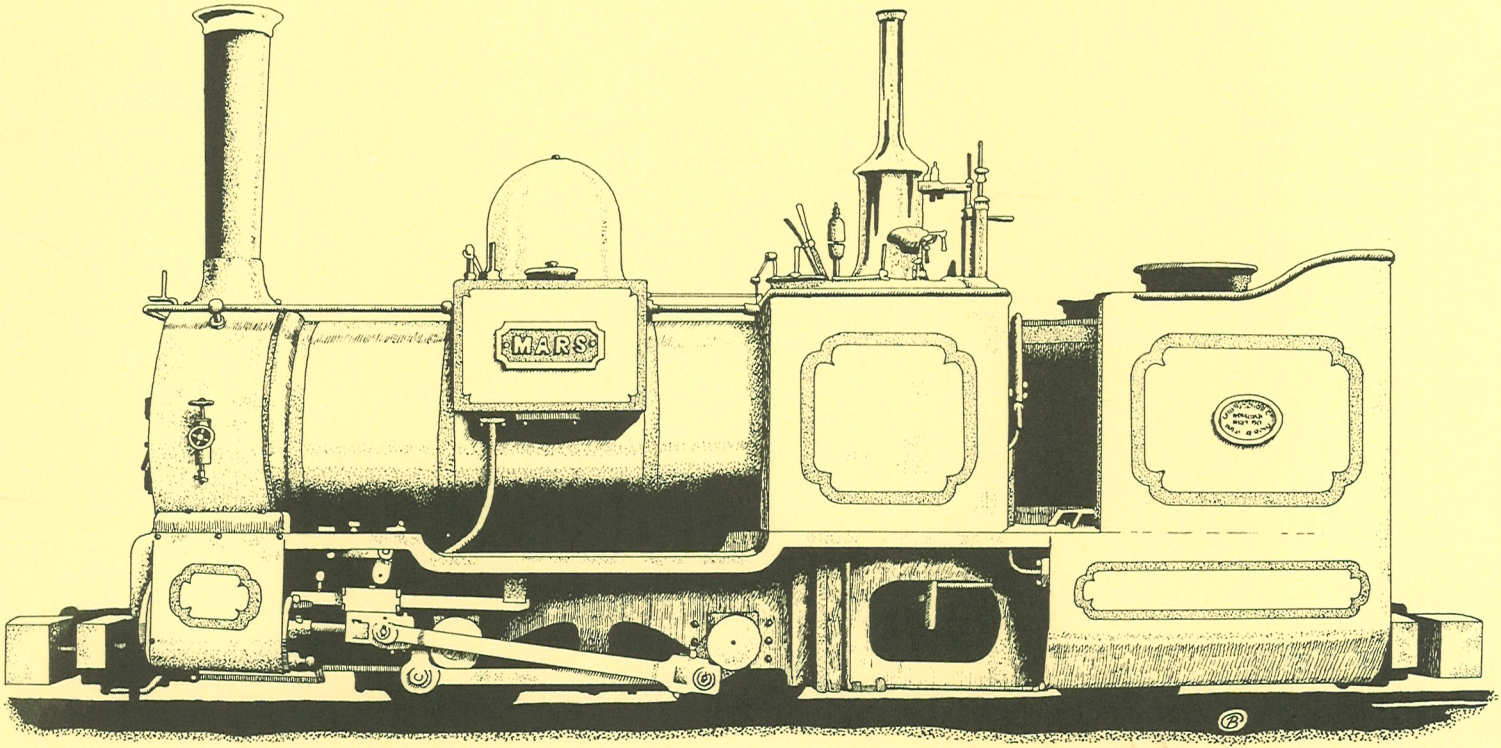
"PHAETON" Kerr Stuart (shown without name plates). Lettering was probably put on the tank temporarily to suit makers catalogue photography. Note the rather long smokebox and plain chimney made in one piece. "PETROLEA" the first oil fired RAR engine was of this class.

"CARRONADE" Hudswell Clarke. Proportion and layout were rather like the Hunslet Dinorwic Quarries "Port" class, though without a dome. The tall chimney shown did not have a polished cap and was later replaced by a wide based pattern housing a Neath spark arrester. "HECTOR" and "HANNIBAL" had similar cabs but that of "Culverin" was more enclosed. Note the smokebox sides were flared in slightly towards the base.


R.C.D.No3


JOHN FOWLER & Co
1885
ENGINEERS LEEDS
25-9-31


CORMORANT
JOHN FOWLER & CO
1885
ENGINEERS LEEDS
29·10·81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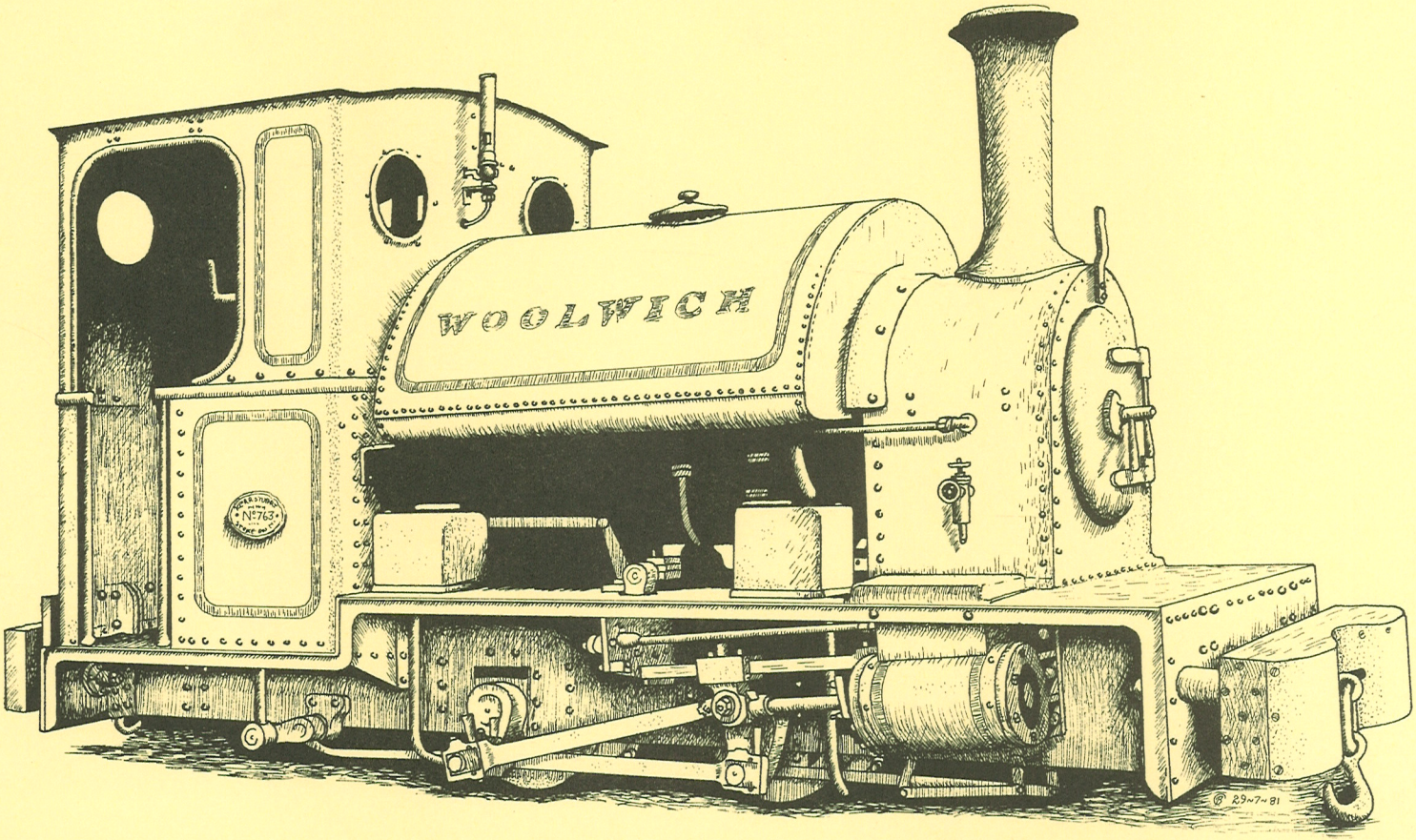
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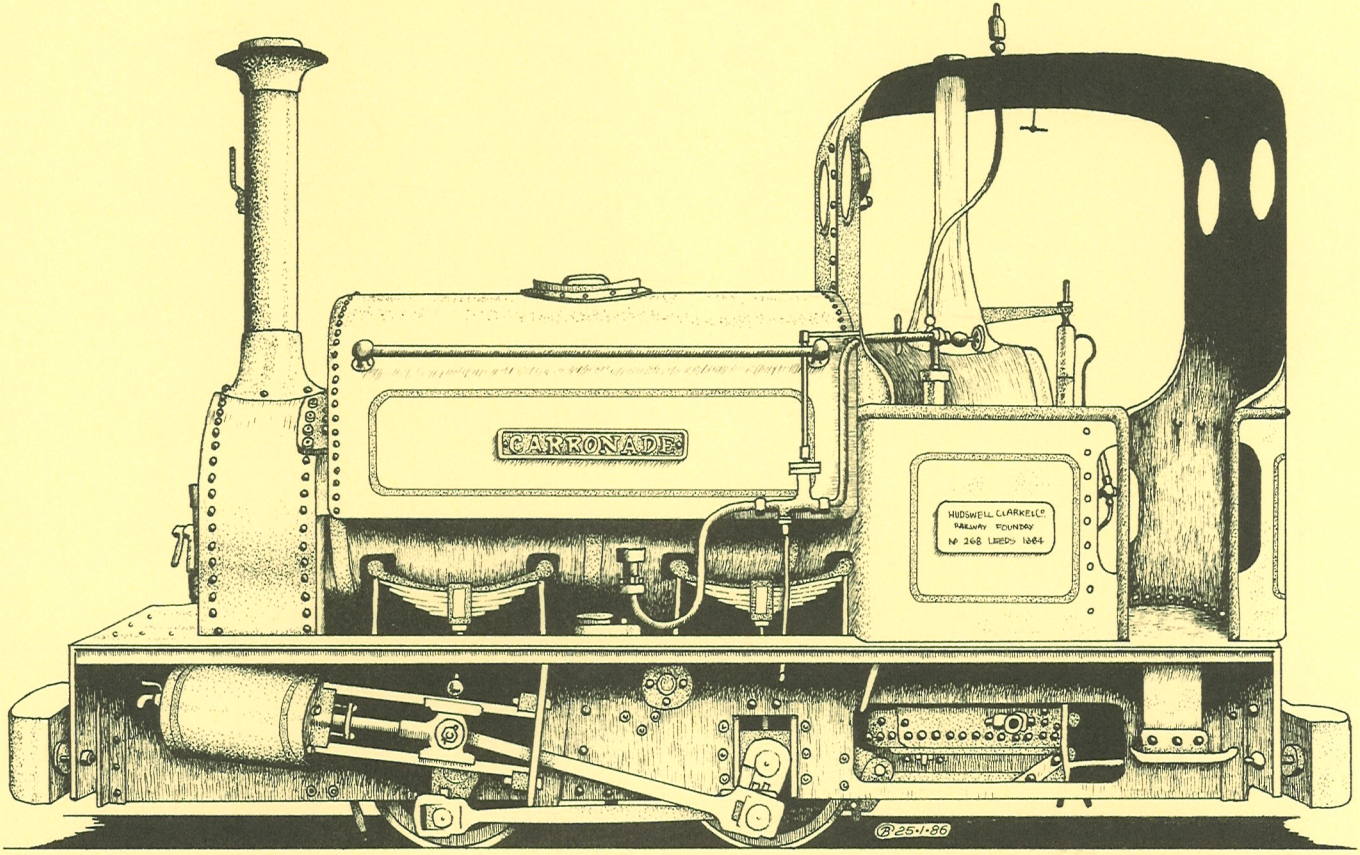
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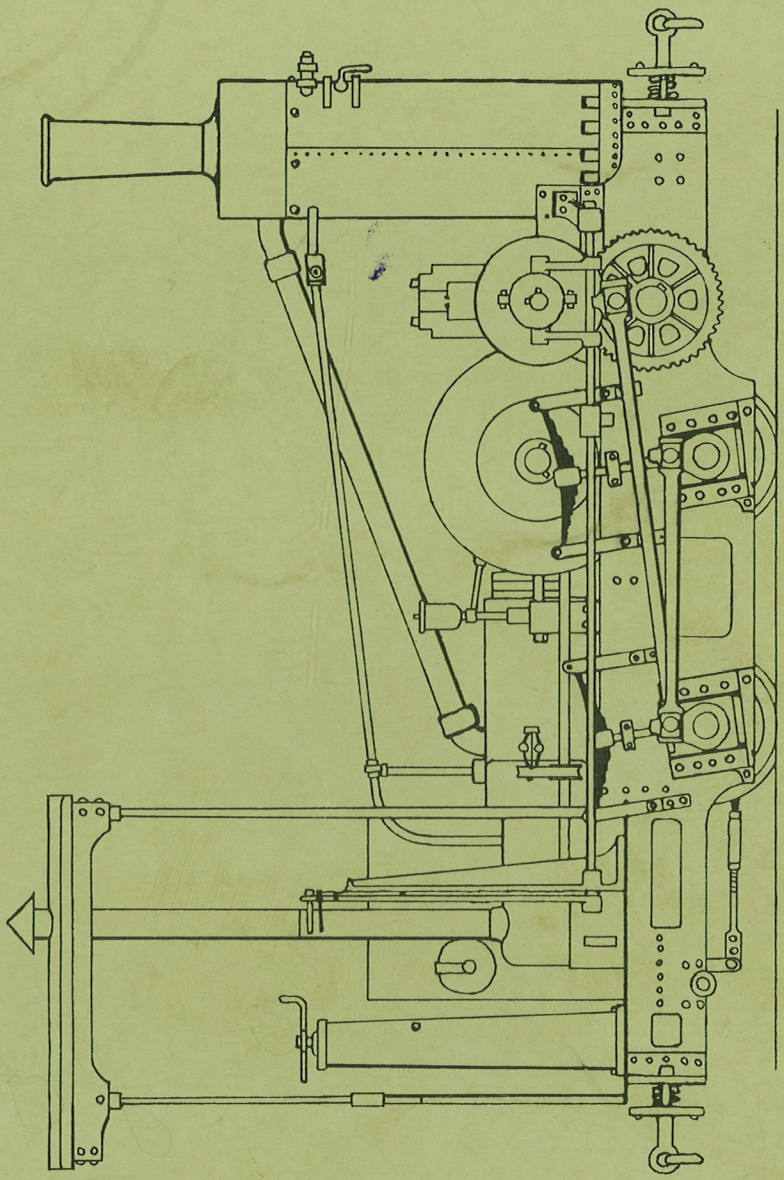

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